Hydrology and Soils Report for the Spring Creek Vegetation Management Project

Redbird Ranger District
Daniel Boone National Forest

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Introduction

This report describes the results of a hydrologic resource assessment for the proposed Spring Creek Vegetation Management project. The project is located on the Redbird Ranger District of the Daniel Boone National Forest. The Forest Service proposes to improve the health and vigor of forested communities, enhance terrestrial wildlife habitats, and provide renewable forest products.

The purpose of this assessment was to determine what effects the proposed project would have on hydrologic and soil resources. Erosion and the impacts to water quality from stream sedimentation will be addressed.

Forest Plan Direction and Additional Design Criteria

The following discusses the direction from the DBNF Forest Plan (Goals, Objectives, and Standards) that relate to roads, erosion, herbicides, and water quality. Additional design criteria are also listed.

Goals and Objectives

1.E. RIPARIAN CORRIDOR PRESCRIPTION AREA– Area adjacent perennial & intermittent streams

1.E-Objective-5.B. Where feasible, new roads should be located outside the Riparian Corridor. If a road is located in the Riparian Corridor, construct to protect riparian functions and values. (Page 3-13)

FORESTWIDE DIRECTION– Upland areas and ephemeral streams

GOAL 3.2. Within the area 25 feet on either side of scoured ephemeral stream channels, maintain the ability of the area to filter sediment from upslope disturbances, control sediment within the area, and maintain channel stability. (Page 2-12)

GOAL 12.1 Minimize road or trail sediment that reaches streams. (Page 2-16)

Standards

1.E. RIPARIAN CORRIDOR PRESCRIPTION AREA– Area adjacent perennial & intermittent streams

1.E-ENG-3. Where risks of resource damage are high, each road segment will be constructed and stabilized prior to starting another segment (stage construction). High-risk areas are those that contain landslide-prone areas, steep slopes, highly erosive soils, or PETS species.

FORESTWIDE DIRECTION– Upland areas and ephemeral streams

DB-ENG-1. Restrict motorized vehicle use in the scoured ephemeral stream zone to designated sites. (Page 2-21)

DB-ENG-2. When culverts are removed, restore stream banks and channels to a natural size and shape. Stabilize disturbed areas. (Page 2-21)

DB-VEG-7. No class B, C, or D chemical (See table below) is to be used on any project, except with Regional Forester approval. Herbicides listed in the table below may be used only for the treatment methods shown. (Page 2-24)

Classification of chemical/method combinations.

TREATMENT METHOD	CLASS A	CLASS B	CLASS C	CLASS D
Manual ground:				
Cut surface	DIC, GLY, IMZ, PIC, TRA	None	None	None
Basal stem	DES, KER, LIM, TRE	None	None	None
Soil spot	HEX	TEB	None	None
Foliar spray	FOS, GLY, HEX, IMZ, KER, LIM, PIC, SMM, TRA, TRE	None	TEB	None
Mechanical ground:	DES, DIC, FOS, GLY, HEX, IMZ, PIC, SMM, TRA, TRE	TEB	None	None

KEY:
DIC = Dicamba
DES = Diesel
FOS = Fosamine
GLY = Glyphosate
HEX = Hexazinone
IMZ = Imazapyr
KER = Kerosene
LIM = Limonene
PIC = Picloram
SMM = Sulfometuron Methyl
TEB = Tebuthiuron
TRA = Triclopyr Amine
TRE = Triclopyr Ester

DB-VEG-8. Herbicides will be applied at the lowest rate effective in meeting project objectives and according to guidelines for protecting human[1] and wildlife health[2]. Application rate and work time must not exceed levels that pose an unacceptable level of risk to human or wildlife health. The USDA Forest Service, Southern Region standard for acceptable level of risk requires a Margin of Safety (MOS) > 100 or, Hazard quotient (HQ) < 1.0. (Page 2-25)

DB-VEG-9. Monitor weather and suspend project if temperature, humidity, or wind becomes unfavorable according to the criteria below: (Page 2-25)

Ground:	Temperatures Higher Than (°F)	Humidity Less Than (%)	Wind (at Target) Greater Than (MPH)
Hand (cut surface)	n/a	n/a	n/a
Hand (other)	98	20	15
Mechanical (liquid)	95	30	10
Mechanical (granular)	n/a	n/a	10

DB-VEG-10. Use only nozzles that produce large droplets (mean droplet size of 50 microns or greater) or streams of herbicide. Nozzles that produce fine droplets may be used only for hand treatment, where distance from nozzle to target does not exceed eight feet. (Page 2-25)

DB-VEG-11. Areas treated with herbicides are to be clearly posted with notice signs to warn visitors of the treatment. (Page 2-25)

[1] NRC 1983
[2] EPA 1986

DB-VEG-12. No herbicide is to be applied aerially. (Page 2-25)

DB-VEG-13. No soil-active herbicide will be applied within 30 feet of the drip line of non-target vegetation specifically designated for retention (e.g., den trees, hardwood inclusions, adjacent stands) within or next to treated area. (Page 2-25)

DB-VEG-14. Do not apply triclopyr within 60 feet of known occupied gray, Virginia big-eared, or Indiana bat hibernacula or known maternity tree. (Page 2-25)

DB-VEG-15. Do not apply 2,4-D or 2,4-DP. (Page 2-25)

DB-VEG-16. No broadcast treatment using herbicide is to be made within 60 feet of any known PETS plant species. (Page 2-25)

DB-VEG-17. No soil-active herbicide is to be applied within 60 feet of any known PETS plant species. (Page 2-25)

DB-VEG-18. Application equipment, empty herbicide containers, clothing worn during treatment, and skin are not to be cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate, labeled containers. (Page 2-25)

DB-VEG-19. No herbicide shall be applied within 30 horizontal feet of lakes, wetlands, perennial or intermittent springs (seeps) and streams. However, herbicides approved for aquatic use may be used when such treatment is required to control invasive plants. (Page 2-25)

DB-VEG-20. Necessary buffer zone areas must be designated before making herbicide treatments so applicators can easily recognize and avoid the buffer area. (Page 2-26)

DB-VEG-21. Herbicide mixing, loading, or cleaning areas in the field are not to be located within 200 feet of private land, open water or wells, or other sensitive areas. (Page 2-26)

Design Criteria

The following design criteria would be implemented after the project is completed to mitigate concerns over erosion and stream sedimentation from access roads on Forest Service lands. These design criteria are estimated to be 100 percent effective.

1. Close and obliterate skid trails as part of this project. Use KV dollars to close any trails that are re-opened for illegal OHV use. The disturbed ground will be seeded and mulched.

Affected Environment

A majority of this project is located in SOUTHERN MIDDLE BREATHITT RUGGED HILLS Landtype Association (LTA). This LTA is characterized by narrow, winding ridges; long, steep-sloped valleys; moderate relief and elevation on surfaces of flat-bedded Pennsylvanian-aged rocks. Cliffs are rare and poorly developed. Soils are deep to moderately deep, grayish-brown Ultisols and shallower Inceptisols. Water quality is general good but varies due to land use.

This LTA is located in the Appalachian Plateaus physiographic province in Kentucky. The landtype association is characterized by moderate relief hills and ridges with associated V-shaped valleys. Elevations range from 1300 to 1700 feet. Local relief averages 400-800 feet. Ridges are narrow and winding. Side slopes average 40-50 percent slope, but may exceed 65 percent in the most entrenched valleys. Rock outcrops are occasionally encountered. Valleys are narrow and V-shaped, with long slopes. Small cliffs are infrequently encountered in the most entrenched valleys. Fourth and fifth order streams have well-developed alluvial bottoms.

Ridges are characterized by soils which range in depth from 20-40 inches or more, but include depths of 0 to 40 inches. Most have moderate clay content in the subsoil and are moderately well- to well-drained. Typical series include Gilpin-Shelocta-Sequoia. Soils on slopes are typically over 40 inches deep, with infrequent rock outcrops and fragments occurring on the lower slopes of more entrenched valleys. Most have moderate to high clay content in the subsoil and are moderately well-drained. The typical series are Shelocta-Cloverlick-Kimper.

This landtype association has a moderate number of small to medium sized intermittent and perennial streams and rivers. Larger streams have moderately broad, flat valleys with well-developed floodplains. Gradients are moderately high and drainage patterns are dendritic. The Red Bird River is the largest stream traversing the landtype association. The Red Bird River through the project area is listed as meeting it’s designated uses for water quality and aquatic biota by the Kentucky Division of Water. (see Figure 1).

Off highway vehicle (OHV) use and gas development are occurring in this area. Both of these activities are contributing to the sediment load in the streams.

Findings

Method of Analysis

For this project stream sedimentation will be addressed and used to evaluate the difference between alternatives. Soil erosion is the detachment and transport of individual soil particles by wind, water and gravity. Erosion not only reduces soil productivity, soil particles reaching streams as sediment, potentially lower the productivity of aquatic ecosystems. This, in turn, adversely affects various consumptive and non-consumptive uses. Sediment is the state’s second leading cause of stream impairment, according to Kentucky's 2002 Clean Water Act 305b Report to Congress. In addition to stream sedimentation the potential for herbicide movement will also be discussed.

A brief account of the process, baseline conditions, current conditions, future conditions, and the effects of each alternative follows. A full set of results can be found in the process record for this Environmental Assessment.

Upland erosion and stream sediment values were determined by following the DBNF Aquatic Cumulative Effects Model (Walker, 2007). The model uses the Water Erosion Prediction Project (WEPP) developed Elliott (2000). It was also based on erosion research by Dissmeyer and Stump (1978) and sediment delivery research by Roehl (1962). The results are expressed in tons per year and the percentage above baseline and current conditions will be discussed. Baseline conditions are calculated by removing all sedimentation attributed to present human influences in the analyzed watersheds. Finally the results are compared to values that were estimated in the Forest Plan Final Environmental Impact Statement. Since the accuracy of the WEPP model, as stated by Elliott (2000) is at best plus or minus 50 percent of the true value. The results should be used only for a comparison between alternatives.

The spatial bounds for the effects analysis include two 6th level watersheds. These watersheds vary in size from 11,149 to 19,815 acres and are approximately 80 percent NFS lands (Figure 1). These watersheds were used for analysis since they are the furthest downstream extent where impacts could be detected.

Research and local experience has shown that effects of similar actions are identifiable for up to 3 years (Miller, Beasley, and Lawson, 1985). The timeframe of the erosion model is bound by activities that occur three years prior and one year following the implementation of this proposed project. This captures the effects of other management activities that may still affect the project area. Proposed actions are constrained to a single year (i.e., constructing the entire project in a single year). This will express the maximum possible effect that could occur. Past activities that have a lasting effect (such as roads and changes in land use) are captured by modeling the sediment increase from an undisturbed condition.

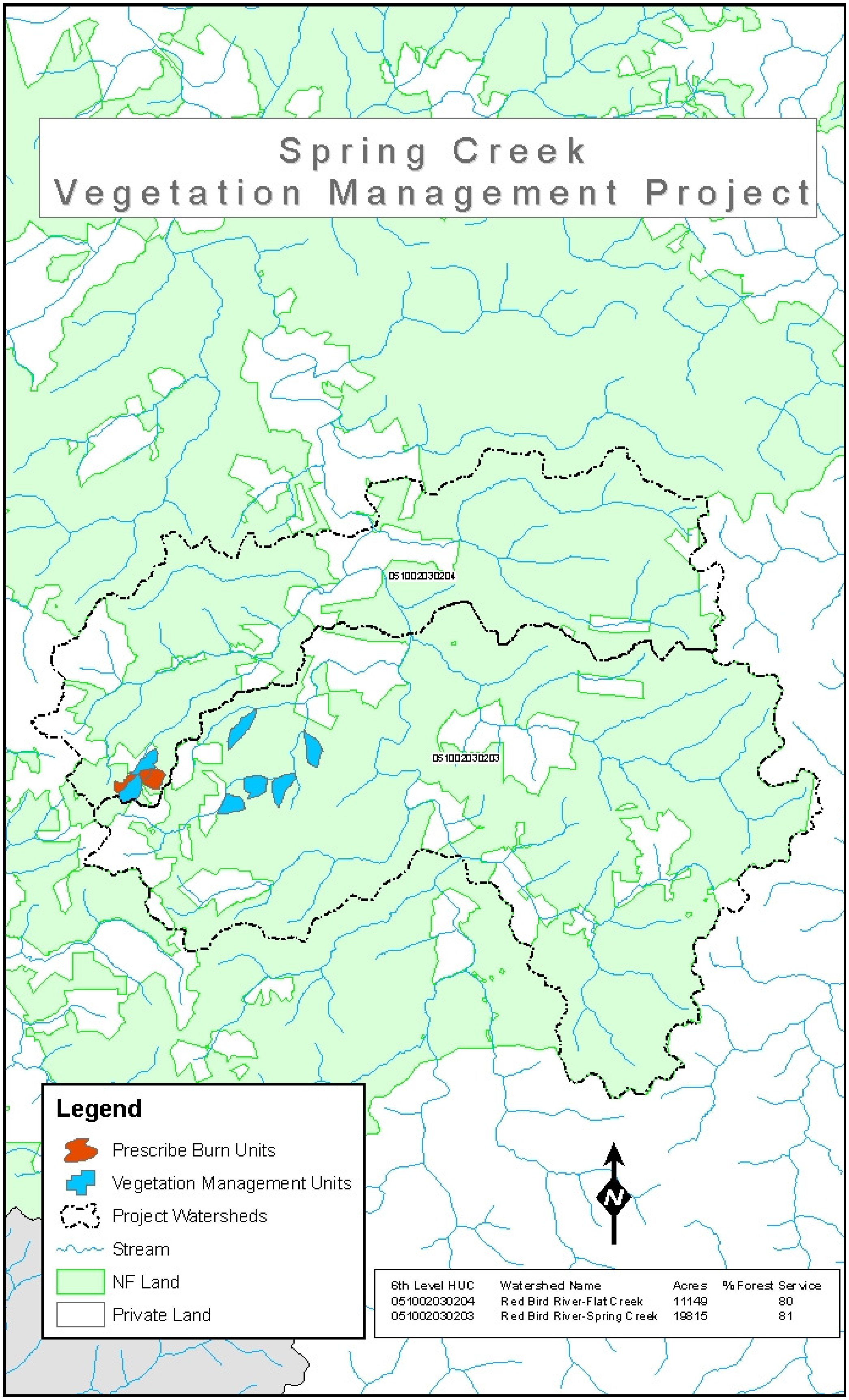

Figure 1: Watershed Map – NEEDS TO BE REVISED

Direct/Indirect Effects

Alternative 1 – No Action

The No Action Alternative would not change the existing upland erosion or stream sedimentation (Table 1) in any of the 6th level watersheds. However it should be noted that the largest single contributor to stream sedimentation is "Past and Present" landuse. Most of this can be attributed to the road system, urbanization, and past mining of private coal.

The local groundwater systems would not be affected.

Alternative 2 – Proposed Action

Stream sedimentation and impacts from herbicide will be addressed and used to evaluate the difference between alternatives. Changes in stream sedimentation in both 6th level watersheds that contain treatment units from this alternative are shown in Table 1. The Proposed Action would produce between 57 and 62 tons/year of stream sedimentation in Flat Creek and Spring Creek, respectively. This represents a less than a 1 percent increase over current conditions. This increase in stream sedimentation can be attributed mainly to skid trails, landings, and temporary haul roads within the commercial harvest areas. This sedimentation would be greatest immediately after ground disturbing activities and will return to pre-harvest levels in 3 years.

There are several reasons why it is unlikely that changes in stream sedimentation of this magnitude will influence water quality in these drainages. As previously stated, for modeling purposes, the proposed actions were constrained to a single year to display the maximum possible effects that could occur. It is much more likely that activities will occur over a several year period which would reduce the total amount of sediment in the stream and any given time. Stream sedimentation will also be spread through time and space. Sediment will only reach the stream during rain events and there are approximately 25 of these events per year. In addition the proposed activities are spread throughout the watershed and as a result the sediment reaching the Red Bird River is staggered through time. Due to all of these reasons it will be very difficult to measure or detect and change in sedimentation at any given point in the Redbird River. It is also unlikely that groundwater will be affected.

Given the standards in the DBNF Forest Plan (pages 2-24 through 2-26); there will not be any effects from herbicides on the streams or water quality in this watershed. In particular standard DB-VEG_19 prohibits the use of herbicides within in 30 feet on any waterbodies. With the use of herbicides there is however a very low risk of a spill or mis-application.

The local groundwater systems would not be affected.

Alternative 3 – Modified Proposed Action (No Herbicide)

The direct and indirect soil and water effects of this alternative would be the same as the Proposed Action. The only difference is since herbicides are not being used the risk to Spring Creek, Flat Creek, and the Red Bird River from an accident is lower with this alternative.

Table 1: Stream Sedimentation

Watershed Number	Watershed Name	Baseline Erosion (t/yr)	Past and Present above Baseline(t/yr)	Proposed Project (t/yr)		Percent Increase over Present Conditions		Future (t/yr)	Cumulative Percent Increase over Present & Baseline Conditions for Proposed Actions	
				No Action	Proposed Action	No Action	Proposed Action		Over Present	Over Baseline
051002030203	Spring Creek	395	9,289	0	62	0	<1.0	35	1.0	2,177
05100203204	Flat Creek	294	6,210	0	57	0	<1.0	20	1.0	2,140

Cumulative Effects

The spatial temporal boundaries for analyzing the cumulative effects are discussed under the "Method of Analysis" section.

Alternative 1 – No Action

Since there are no direct or indirect changes to the existing condition from this alternative, there would be no additional cumulative effects. Under current conditions, the stream sedimentation levels are within thresholds estimated by the Forest Plan (FEIS pp 3-20 & 3-21) and are in the excellent range. As mentioned above any sedimentation is a result of human activities on private lands or past activities.

Alternative 2 – Proposed Action

As shown in Table 1 a majority of the sediment increases in these watersheds are due to past activities. More specifically, the largest increases in stream sedimentation are from existing "Past and Present" landuse changes that have occurred over the last 200 years. A majority of these changes have been the conversion of land from forest to either roads or low density urban use. Future sources of stream sedimentation might include minor stream sediment increases from pre-commercial thinning, maintaining wildlife openings, pond development, research projects, and timber cutting on Forest Service and private lands. Several of these projects where used when running the cumulative effects model but others are still too speculative to make accurate sediment predictions and are subject to future independent decisions.

In the affected watersheds the cumulative percent stream sediment increases over current conditions are estimated to be approximately one percent. These changes are often offset by other restoration projects in the watersheds (i.e., road and OHV trail closures). The cumulative percent increase of all activities (past, present, and foreseeable future actions) over baseline conditions in Flat Creek and Spring Creek is between 2,140 and 2,177 percent, respectively. As previously mentioned, baseline conditions are calculated by removing all sedimentation attributed to present human influences. There is no measurable change to the Watershed Condition Rank or the Species Sediment Load index listed in the Forest Plan (USDA Forest Service, 2004, FEIS, page 3-20) from this alternative and would still be in the excellent range.

Since the direct or indirect changes to water quality from herbicide runoff are unlikely, there would be no additional cumulative effects.

Alternative 3 – Modified Proposed Action (No Herbicide)

The cumulative soil and water effects of this alternative would be the same as the Proposed Action.

Determinations (if any) / Compliance with Other Laws

This work complies with Kentucky water quality regulations (401 KAR) and the Clean Water Act.

Consistency with Forest Plan

Based on the analysis the Spring Creek Vegetation Management project is consistent with Forest Plan direction for hydrologic and soil resources.

Monitoring

A majority of the soil and water effects are from skid trails and landings. To reduce erosion it is important that these areas are properly closed and remain closed in the future. To ensure that this occurs, site inspections will occur immediately after completion of the project and one year later. The disturbed areas will be inspected for erosion control structures, soil movement, and illegal use. The monitoring should be funded with KV dollars.

Summary for Hydrologic Resources

Based on field work, water quality modeling, and best available science there would be no adverse effects to any of the hydrologic resources as a result of this undertaking if the provided recommendations are followed. The Spring Creek Vegetation Management project is consistent with Forest Plan direction for hydrologic resources, meets or exceeds Kentucky water quality regulations (401 KAR), and complies with the Clean Water Act.

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